



Digital Learning Challenges and Innovations for Sustainable Education in Developing Countries: Issues of Policy and Practice

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INSPIRE XXIV

**Global Connectivity
and
Learning across the Generations**

Editors:

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Digital Learning Challenges and Innovations for Sustainable Education in Developing Countries: Issues of Policy and Practice

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Abstract

Social Innovation (SI) as well as digitally developed SI are playing a critical role globally in solving complex contemporary social challenges and are gaining popularity in developing countries. This study defines SI as the development and delivery of new ideas and solutions (products, services, models, markets, processes) at different socio-structural levels that intentionally seek to change power relations and improve human capabilities as well as the processes by which these solutions are executed. SI has become influential in practice, scholarship and policy as the conceptual basis for organisations, from grassroots movements to Social Development Goals (SDGs) and the European Union strategy. In developing countries such as Kenya, SI come in many guises, at the core of which lies the application of digital solutions to resolve emerging social problems. The application of digitised solutions requires the development of ICT literacy in the form of e- learning so as to enable the development of 21st century skills. Discourses on ICT integrating in development has been going on for over 30 years and with this comes the need for applicable and sustainable e- learning targeted at various groups.

Using archival data, this paper considers new contemporary challenges and the need to develop 21st century competencies. It will investigate digital learning challenges and innovations in developing countries in general but with a focus on Kenya. It will examine policies that facilitate and implement best practice.

Significant for this study is that digital SI acts to support and (a) improves welfare and therefore human capabilities and that SI including development ICTs (b) reaches its target only if the most vulnerable in the population are affected and integrated. The topics of technology use in education in particular and SI in general are popular in practice but there is limited research on their impact, an area this paper will contribute to. There is rapid growth of ICTs and therefore published works on this topic in numerous disciplinary fields. Therefore, as opposed to full reviews, this paper offers a broad overview in some areas and where possible and applicable examples to illustrate themes and arguments. A thorough examination of the data concludes that there are common themes regarding ICT integration which have persisted overtime. Consequently, among other solutions, theories that delve further than access as barriers such as the Capability Approach as well as transdisciplinary collaborations are the solution to enabling sustainable digital learning.

Keywords: ICT policy, e-learning, digital learning, education, developing countries

1.0 Introduction

The ideas of ICTs ubiquity, availability and widespread use is common knowledge but despite this, questions still exist as to what extent it is contributing to development especially for the targeted poor [1]. Articles by Walsham and Sahay [2], Avgerou [3] and Heeks [4] all indicate that the general discourses regarding ICTs include (a) technology and knowledge transfer, (b) a process of socially embedded action and (c) transformative interventions. These topics were popular then and still are the most prevalent and will be explored as they affect ICT integration today. This is evidenced in literature surveys by Gallivan [5] and in the setting of future agenda for the field article by Heeks [6].

Technology integration is pedagogically important as it enhances the learning environment in a creative way to transform the education landscape [7]. Examples include the One laptop Per Child (OLPC) initiative introduced by a couple of United States Non-Profit organisations. Basic XO laptops costing \$100 were offered to provide a multimedia, collaborative user interface with educational software in a bid to cover large populations. Other countries adopted the idea, for example in 2001, Thailand rolled out the One Tablet Per Child (OTPC) programme by issuing 800,000 units and later increased by a further 2 million. Other countries that took similar paths include Peru, Uruguay, Mexico, Ethiopia, Cambodia, Brazil and India [4]. There are other informal experiments-based projects including the Minimally Invasive Education (MIE) [8]. This is a hole in the wall experiment which illustrated that ICT enhanced learning in children between 8-14 years of age. This was achieved through discovery, exploration and peer coaching with minimal invasion. Another such experiment is the Worldreader project where e-readers are

preloaded with e-books and distributed to school libraries in developing countries for children to access [9]. This on evaluation demonstrated improvement in reading proficiency as well as interest in literature. Studies in Thailand demonstrated that student learning had improved [10]. Studies which explore the role that education plays in promoting economic growth corroborate the importance of cognitive skills of a populace as fundamental to sustainable development [10]. This is also corroborated in studies that relate skills development and growth as well as the role scientific literacy plays in eliminating social obstacles that hinder progress to democratic and humane societies [10].

Against this backdrop, this paper is organised as follows. The next section looks at ICT and policy in the developing country contexts using Kenya as an example. This is followed by an outline of why ICT Integration is deemed important. It then investigates any learning that can be applied to enable transformations and change in ICT integration considering criticisms of past efforts and then explores and outlines ideas for solutions. Finally, it concludes by providing an overview of challenges as well as criticisms that will pave the way towards more successes in integration.

2.0 ICT in Low Income Countries

The growing inequality in Kenya is a situation that is reflected when it comes not only to access to education in general but also when it comes to digital integration and e-learning. This is contributing to the digital divide. The digital divide refers to the gap between the digitally literate and those that are unexposed and/or illiterate [11]. Brandtzæg et al. [11], class internet users as non-users, sporadic users, instrumental users, entertainment users, and advanced users. Within these categories, non-users and sporadic users form the digital divide [12]. This disparity in access to ICTs limits the effectiveness of national innovation systems claim Wiseman and Anderson [13]. Most ICT literature places the role of integrating ICT execution as mainly falling on the administration, meaning governments, hence the need to analyse ICT and education policy.

The Kenya government proposed the use of ICT to supplement current resources in a bid to remedy the digital divide as well as integrate ICT in schools with mixed results [10]. The introduction of the tuition-exempt primary education in 2003 was to fulfil the Education For All (EFA) promise as well as to improve overall education outcomes which included ICT Integration. The result has been enrolment increase in many countries, Kenya included, but, the quality of education is falling due to the surge that has overwhelmed the infrastructure. The result is overcapacity in classrooms, overworked and frustrated teachers and overstretched resources on a limited education budget [10], [14],[15]. The role of integrating ICT tools in teaching and learning activities in Kenya is carried out through Kenya Education Sector Support Program (KESSP). The National ICT Strategy for Education and

Training [16] bears the mandate to achieve Education for All (EFA). Despite these efforts, ICT integration and e-learning is mostly not established especially for the neediest groups.

In ICT policy adoption and reforms, most literature considers the administration as the key decision maker [10]. But, as with many African countries, policymaking is influenced by external factors such as donor agencies, aid dependency as well as a lack of policy debates among the involved stakeholders. These hinder a coherent ICT development action plan that serves all equally [10]. This situation, argue scholars, prioritises the ineffective top down approaches as opposed to noble cases of technology led community-based organisations [17] and the exploration and use of low-cost computer technologies [18]. Despite the efforts to extend access to education and to integrate e-learning as an aid in education, quality education as well as e-learning is only accessible to the privileged which leads to further inequality [19], [14]. In primary schools the government is expected to bear the cost but instead encourages private sector facilitation which though more reliable is more expensive. Due to this, where ICT integration is achieved, there are frequent extra financial burdens incurred [7]. Other policy stakeholders have also contributed to the debate on ICT integration. For example, on digital dividends, the World Bank reported that a lack of strong absorption capabilities in the digital technology sector would lead to meagre benefits [20]. With education cited as undoubtedly the major foundation of sustainable growth, without ICT integration, digital dividends would not be realised for the next generation. According to UNESCOs 2015 [21] report, mostly efforts fall short as resources such as infrastructure and human resources are unable to meet expectations of the reform strategies proposed. It reports that ICT can play a role in enabling universal access to education, boost equity and enrich delivery of quality learning and teaching. To establish this, mindset changes from the stakeholders including educators, curriculum developers, administrators and policy makers, is necessary. Thus, there seems to be an agenda on paper but in practice, digital learning policy framework is not effective especially for the poor who need it the most [22], [17].

On the practical side, poor allocation of resources is cited as the key hindrance to the integration of technology in education [7]. This is despite the backdrop of the widely recognised position that ICT integration relies on more than access and resources, that ICT is key to gaining global competences as well as enables the taking part in the current connectedness as pathways to resolving current global challenges [22], [23]. In line with SI principles and in a bid to leverage the ICT promise, Kenya has formed partnerships with actors in the private sector, a case in point being between Microsoft and the government [22], [4]. Two issues arise from this, firstly, this is a demonstration by the government of its incapacity to deliver education, the second is to what extent can large scale private companies be relied on as providers of infrastructure and equipment for long-term public projects [4]. Despite these issues in policy and practice, ICT is still considered key to enabling development, the next section examines why this is the case.

3.0 Prioritising ICT in developing countries

The reasons given as to why IT is important can be viewed from a micro to macro level. On the micro level, the weight accorded to the role ICT can play and therefore the need for integration firstly falls on its capacity to support the enhancement of intellectual and rational abilities. It has also contributed to positive learning outcomes [24]. On the macro level, in his 2008 paper, Richard Heeks[4] argues that firstly, it is a moral argument for ICT experts to focus less on corporates and offer some attention to resolve some of the planet's mega problems such as climate change, conflict, terror, diseases and resource depletion among others issues. These he claims are stacked up against and faced by the poorest people who live on less than 2\$ a day. The second reason he cites is self-interest as transference of these problems in the forms of migration, terrorism and diseases can and is happening in a globalised world. Thirdly he also argues that designing a system that resolves an issue in a developing county and that then contributes to poverty reduction offers a greater sense of satisfaction than just more of the normal setups required by corporates. It would also lead to the empowerment of the poor which he proposes would offer a market base. Overall, the economic social and political life in the 21st century will be increasingly digital and those without digital skills will be increasingly excluded [16], [25], 26].

Discourses regarding ICTs importance begun over thirty years ago. In development studies Information and Communication Technologies for International Development (ICT4D) 1.0 and its progression to ICT4D 2.0 were the buzzwords which represented the IT path to integration [4]. This path has moved through the development phase, MDGs, bottom of the pyramid, proliferation of ICT especially mobile phones from 2000 onwards and SDGs right to the present. Mobile phones are having an impact on lives in poorer communities and has led to interdisciplinary involvement in ICT research. Computer scientists are developing apps, sociologists and anthropologists are encountering mobiles in their studies and in development studies, where in the last decade ICT was scarcely mentioned, Robert Chambers [27], now talks of a cornucopia of potential referring to a new domain of participatory action. Despite all this effort, the results are mixed - mostly failure, restriction and anecdote. These outcomes have led to specific lessons and new watchwords including (a) sustainability, where ICTs failure to deliver and survive begged the need for longevity, (b) scalability, where expansion or replication of individual telecenters was hindered and (c) evaluation, which was to ensure the hype was corroborated through objective impact evaluations [4]. Gender had been largely ignored despite the evidence that ICT could play a role in empowering women in several ways [28]. There is interesting work regarding this by Oreglia & Srinivasan [29] on how or whether they can renegotiate their patriarchal social structures. One of the main challenges to ICT Integration is learning. The next section attempts to analyse learning in ICT Integration.

4.0 Learning and Change

The goal for ICT integration is to enable development, the challenge is enabling learning that leads to development. From 2000 onwards, a recurring challenge has been to accurately define development with relation to ICT [2]. Efforts include published work on the Human Development Approach with its links to the ICT as artefact [30], the demonstrating of theories of development as applicable to specific e-commerce approaches [31] as well as Gallivan & Tao [5] who draw on Sen [32] and the capability approach (CA). There is no prescribed or specific method to integrate ICT although attempts have been made by scholars to develop theories and methods [10]. Learning aids include the use of text recommendation systems such as Balabanović's work which delivers appropriate content based on a learner's experience and feedback preferences [33]. Polydoropoulou & Lambrou suggested a content advisory system that was helpful in the studied shipping industry as it enabled the effective adaptation to new roles and responsibilities [34] while others have developed the aptitude-based system [35]. Wang suggests that in order that independent learning is enabled, e-learning systems need to be guided by personalised learning adaptation and a self-regulated learning environment which would enable efficiency [36].

Several studies have been carried out to establish theoretical bases for technology adoption [7]. Examples of these include models such as the theory of reasoned action (TRA) developed by Ajzen & Fishbein [37], the theory of planned behaviour (TPB) [38], and the theory of acceptance and the use of technology (TAUT) [39]. These models have been applied by scholars to empirically illustrate the appropriate models which support student's acceptance of learning environments [40]. Heeks [4], proposed two approaches on how diffusion would occur as either 'passive diffusion' or 'active diffusion'. Passive diffusion allows the progressive spread (as is happening with telephones) to result in profit for private firms and value for the poor. On the other hand, 'active diffusion' believes the market will be slow to support the poor hence the need for innovations that better meet development goals. Lessons learnt in ICT4D 2.0 were that large-scale operation proved risky and not successful therefore the emphasis was on smaller scale efforts executed by either adapting or applying existing technologies that may be in forms of pro poor (outside the community but on their behalf), para-poor (working alongside the poor), and per-poor (within and by the poor) [4].

Adopting ideas from grassroot innovations for sustainability is increasingly getting attention in policy, academic and activist debates but little research has specifically been conducted on how transformative perspectives, strategies and action emerge [41]. Results arising from these strategies found that micropolitical and macropolitical factors are drivers that influence the emergence of first- and second-order learning. In turn, this learning moulds three different strategies proposed by this grassroots initiative, namely: commercial, social, and empowering strategies. Challenges to ICT integration and e-learning are persistent and ongoing as they

echo general developmental challenges. The next section is an overview of these challenges.

5.0 Digital learning challenges: barriers to learning

Without the integration of ICT in education, education reform is incomplete [42]. The use of traditional approaches to teaching and the learning environment seem to hinder the development of information access and in turn widening the knowledge gap. This is then broadening the digital divide and can only be mitigated through effective ICT integration [7]. Awareness, access, attitudes and applications is the 4A perspective which focuses on digital gaps at the local/community level and also applies to the national/global levels [12]. The challenges with ICT integration can be analysed from the macro basis and micro basis although looking at the macro approaches are marred with records of failure [7]. Complex policy environments as a result of multiple stakeholders, technocentricity and a lack of contextual considerations are key barriers.

In policy terms, a multiplicity of actors each with their own agenda are involved in delivery of services that may be best designed and delivered as public [7]. These may operate outside of a policy framework and within environment with unclear agendas which may not be of national interest moreover they mostly lack coherent policies. Technocentricity and contexts emerge as barriers. Technocentricity is described as situations where computer scientists create technically sound systems but which fail to make any developmental contributions [4], [7]. Critics of technocentricity claim that attempts at integration are made without considerations based on preference which relates to the issue of context. Context and cultural aspects pose difficult barriers to implementation of ICT as they represent the social basis within which technology is interpreted and given meaning [43]. ICTs therefore should be conceptualised from social systems within which technology is considered another dimension [23]. Developing countries lack access to relatable, culturally conscious digital content [44], [39]. To establish context and content, key themes arise which include participation and collaboration Korpela[45], indigenous design [28] and efforts be embedded ICTs within wider change efforts [3], [23]. On the same thread lies the debates on standardisation verses localisation [2]. Generally, policy and context are older themes which still have echoes today although others have also come to prominence, an example being the interdisciplinary aspects that are lacking and are required to enable effective, transformative integration [46]. Within context also lies lack of gendered consideration [12] that is ignored by some ICT scholars claim Walsham and Sahay [2] but is deemed key by others including Brännström [46] and Gillard [47].

On the micro level, access is the biggest challenge among the neediest. Warschauer [26] states affordability as a major factor that widens the digital divide creating a gap in the knowledge society. Studies thus demonstrate that the digital divide is

bound to widen if the underlying issue of affordability is not addressed [26]. There is very poor infrastructure in terms of roads and access meaning long journeys and even should access be guaranteed, power outages and expensive alternatives for power generation then hinder access. Together with these, internet connection is very poor in remote areas. Access is further hindered by inadequate human resources where skill and empowerment disparity in terms of access and end-to-end proficiency in technology is commonplace. Studies such as one done by Ali & Magalhaes [44], and Butler & Sellbom [48], found language barriers, workload and lack of time as further barriers. Al-alak & Alnawas [49] identified perceived usefulness, ease of use, and prior computer knowledge as key barriers.

The idea of the PC and internet connectivity are the barriers in themselves claims Heeks [4] as the cost of units as well as the internet for the poorest makes this an impossible idea. Heeks mentions (a) terminals, meaning low cost computers in initiatives such as one laptop per child (OLPC) as one prominent product, (b) Telecommunications especially wireless options are popular, and finally, (c) power with only 15 % of rural household having electricity means the need for new low-cost devices for electricity generation and better ways to store carry, transmit and reduce power consumption. He poses the challenge to focus less on the PC and move towards mobile phones. There are lessons to be learnt from attempts at ICT integration which form the springboard that would enable better ICT integration in future. A Full evaluation of ICTD interventions is difficult as its outcomes are often intangible in nature [50]. A way around this is not to focus only on impact but on other elements in the project life cycle.

6.0 Possible Solutions

In terms of what development means, ICT integration ideas need to move from the simplistic notions of access and finance as barriers. Scholars such as Gigler, [52] drawing on Sens Capability Framework to examine the impact of ICTs on disadvantaged communities. He goes further to identify a more complex ICT impact chain. This implies a need for enhanced capabilities including, information capabilities for the poor, communication capabilities, information literacy and knowledge sharing abilities. Gigler [52] emphasises the role of intermediary organizations in supporting disadvantaged communities to harness and develop necessary skills. Solutions also lie in the development of ICT models which transform processes and structures of development such as connecting the excluded [4]. SI as social enterprise models based on ICT and other unique practical ideas such as political and conflict analysis models of which Ushahidi are examples to learn from [46]. Context as emphasised by Mandon [53] plays a role, she argues that technology-based projects must not be studied in isolation but within the broader historical processes of development and governance as evolved within the said context. In the same grain Slater [54] in his book talks of western centric notion of development meaning to raise developing country standards to western ones. He argues that terms such as new media, globalisation and development should be sought and grounded in diverse everyday street life.

There is an agreement that gender as an issue is important for ICT integration. On women and ICT [46] insists that it is a topic that must not exclude men given that both male and female attitudes are important and that the study of ICTs becomes part of the mainstream. Women play a critical role where ICTs are introduced such as entrepreneurship, health, education, agriculture, and, commerce which then means that in future gender should feature in ICT in a major way [47]. Specific gendered challenges need to be addressed to enable access [53].

Considering access and finance, several solutions are proposed. Heeks[4] observing the challenges of the PC route, proposes the use of mobile telephony and tablets as having better potential. Mobile phones already reach more than half the African population. He however insists the calls and SMS only models need to be replaced by smartphones to offer better platform for exchange and learning. Innovation requirements are thus that the bottom-up smartphone diffusion rises to meet the top-down lower cost PC terminals and not to forget the over 80% who already possess radio and television sets [4]. Tabira and Otieno [10] also cite the use of pre-recorded DVD based content as an effective solution and that teachers are best suited to lead in the design of the material in a community of practice of teachers. Pedagogically designed content is argued as one of the pathways to enable learning [7]. This should occur in an iterative collaborative fashion as opposed to the traditional top-down approaches [10]. Wang's study shows how such content in the form of interactive flash animation improved elementary learning [36]. This can be amplified on a large-scale deployment plan when reliable and authentic content is developed even without the help of instructors [55]. This is however dependent on quality of content and ease of use. The internet thus provides a platform for a variety of content in the forms of non-commercial, commercial, or open courseware which can be used as supplementary to the main content [7]. Open source systems, single board computers or microcomputers are cheaper than regular computers thus limiting the issue finance as barrier.

The deployment of e-learning on a larger scale may still mean maintenance fees and updating costs which could be expensive in the long run. A Community based service preference addresses needs such as allocating for communal diversity necessary for participation, ownership by community thus ensures public acceptance, increases and fosters entrepreneurship and innovations such as e-commerce, virtual banking and e-villages. These however have limitation such as lack of scope and grappling with trying to unite segregated initiatives [7]. Thus, the onus is left for governments to develop policies which promote innovation on digital content as well as initiatives to improve internet connectivity for impact.

Among scholars' criticisms of efforts at ICT integration are that there should be a move beyond mere application to more attempts at theorising development issues [4], as well as move the focus on the market regime as if the only possibility for ICT application lies in economic and social gains [3]. In later research and

observation from conferences, the GRACE Network is lauded for its transdisciplinary core [46]. He criticises the newer ICTD conferences as either ignoring development theory, and while multidisciplinary in attendance, scholars attend session within their discipline and therefore negating the interdisciplinary potential. A final criticism is the lack of delving into the political and economic agenda such as which technology is being pushed for and why.

7.0 Conclusion

Digital technology is prevalent, but questions remain as to what extent it is contributing to development and how it can be harnessed to produced results. Studies have shown that e-learning can play a role in schools. Efforts at integration in low income countries result in growing inequalities as mostly the privileged can gain access to ICT, contrary to efforts the aim which is to include the less well off. Government policies are often set up with the aim of working in conjunction with stakeholders whose agendas may not be aligned to what it takes to actually enable working integrated ICT and e-learning systems. ICT integration's significance includes the development of cognitive levels and what this means for development and inclusive citizen participation. Globally ICT integration plays a moral and self-interest role. Heeks[4] argues that to ignore developing countries is to the detriment of the West as with globalisation and migration, a more equal society serves to enable positive exchanges socially, economically, culturally and politically.

Enabling learning is key to integration. This applies to both learning from past ideas, successes and failures as well as e-learning which is actual application or use of and application of digital platforms. Debates suggest that together with access, context is important and even more important ensuring that theory and practice are applied to integration efforts. The Human Development and Capability Approach (CA) offer theoretical basis though which integration can be analysed to enable results. Gender must also be considered not just as creating opportunities for women but including both sexes when developing ICT policies. This is to ensure gender does not mean a limitation to access.

In ICT, discourses have generally remained the same namely sustainability, scalability, and evaluation. What comes across is therefore the need to find a path to progress. Scholars are still in favour of the administration as key when it comes to ICT integration which would ensure inclusivity. Governments are also taxed with the role of enabling structural access especially to the neediest. An emerging discourse is the role that a transdisciplinary approach could play. Given the persistence of unresolved underlying discourses regarding ICT and e-learning, the complexity of factors that affect learning and therefore integration will be best resolved when transdisciplinary teams work together.

Recommendations for further research are mainly derived from scholars' criticisms of efforts at ICT integration. The first is that there should be a move beyond mere application to more attempts at theorising development issues. The second is to shift the focus on the market regime as the only possibility for ICT application to incorporate aspects beyond economic and social gains. Thirdly, pursue, experiment and highlight efforts at more interdisciplinary approaches and lastly delve into the political and economic agenda such as which technology is being pushed for and why.

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